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North America's Raw Material Needs

NORTH AMERICA supports the world's highest standard of living for almost 200,000,000 people and is by far the world's largest consumer of industrial raw materials. The United States and Canada together consume, for example, about half the total world supply of crude petroleum and bauxite; one-third of the iron ore, copper and zinc; two fifths of the nickel and sulphur, and more than four-fifths of the natural gas.

Particularly encouraging, at a time when the production of many metals and minerals has temporarily outstripped demand and a good deal of excess capacity exists, is a report entitled "The Future of Industrial Raw Materials in North America", which foresees a doubling of the huge requirements of this area in less than 18 years, given a growth of materials consumption at a rate slightly in excess of 4 per cent a year.

The authors of this report are the Canadian-American Committee, a body sponsored by the National Planning Association (U.S.A.) and the Private Planning Association of Canada. The study attempts to assess the long-term outlook for industrial raw materials in North America, assuming that minor cyclical fluctuations and international conflicts will continue to occur. It does not take into account the possibility of any major recessions or major wars.

For each of the forty-six principal industrial materials consumed in North America, a "balance sheet" is developed. Its purpose is to portray the quantity produced in North America (Canada and continental United States); the volume of domestic demand; the quantity shipped between Canada and the United States; the quantity produced in the Free World; total world production; and the quantity that must be imported into Canada and the United States to compensate for deficits of domestic supplies. Some of the conclusions are given on page 39.

The Committee emphasizes that the commodity projections are merely indications of the level of consumption under specified circumstances, and that continuous reappraisal is necessary if such projections are to serve as more than an ephemeral guide for intelligent decisions and advanced planning.

Canada and the United States have each made extensive studies of their respective raw materials supplies and future requirements, the most extensive being those of the President's Materials Policy Commission (Paley Report) in the United States and the Royal Commission on Canada's Economic Prospects (Gordon Commission) in Canada. These studies, it is suggested, were perhaps conducted at some disadvantage in view of their closeness to World War II. It is claimed that the new study utilizes more fully the post-war information that is accumulating and that it applies improved techniques to glean from past experience the trends that may be expected in the future and to achieve consistency within

the projection patterns. The base chosen for the projections is the period 1955-57 and all projections are to 1980, the year used in the Gordon Commission projections. The Paley Commission made projections to the year 1975.

In a foreword to the study, the Canadian - American Committee states that during the past three decades raw materials consumption in the United States and Canada, taken together, has approximately doubled, while the total volume of output of goods and services in the two countries combined has risen by about 2½ times. Moreover, because of the high levels of investment and the faster pace of economic growth experienced since World War II, raw materials consumption has been rising more swiftly, at a rate that would result in an approximate doubling of such consumption in only a little over two decades.

Attention is drawn to the increasing economic interdependence between Canada and the United States which has accompanied these trends, particularly through an enormous increase of trade in industrial raw materials and through vast capital flows to develop new resources. Over the past 30 years, Canadian exports of raw materials to the United States have grown approximately 3½ times, with a sharp accentuation of the trend in the post-war period.

Not touched upon by the Committee is what might be termed the reverse of the medal, namely the premium on the Canadian dollar caused by the large amounts of foreign capital which have flowed into the country during the past 15 years and the large amounts of money which Canadians have been borrowing from other countries, mostly in New York. One consequence of the preponderant role of United States capital in the development of the Dominion's resource and manufacturing industries is that today a relatively few companies controlled by non-residents own most of the oil and gas industry, and are also predominant in various sections of the mining, smelting and refining industry. On the other hand, it should not, of course, be forgotten that without foreign capital many of the spectacular developments which have created jobs for many thousands of workers and given Canada its present position as one of the leading suppliers of minerals, could never have been brought to fruition.

The Prime Minister, Mr. John Diefenbaker, and his colleagues in the Canadian Government are deeply concerned at Canadian dependence on foreign capital and, in particular, at the heavy concentration of American investment in some of the country's most important industries. It will be recalled that one of the first actions of the Diefenbaker Government was to announce plans for reducing Canadian imports to the United States by encouraging the expansion of trade with Britain.

One of the main objectives of the supplementary Budget recently introduced by the government is to reduce the premium on the Canadian dollar by discouraging Canadian corporations, provincial governments and municipalities from borrowing in New York City and other outside markets. The measures adopted, together with the Finance Minister's forecast of a $286,000,000 deficit in the Budget for the fiscal year ending March 31, have already led to a sharp fall in the premium on the Canadian dollar. This will bring long overdue relief to Canadian producers of metals and minerals, whose profits have been heavily eroded by this drain on export earnings, and at the same time it will strengthen the position of local manufacturers in the domestic market.

While there can be no question as to the wisdom of keeping a restraining hand on the inflow of foreign capital and of broadening Canada's trade with Britain and other countries to the fullest possible extent, there is of course, no getting away from the fact that, despite such present causes of friction as United States tariffs and the quota restrictions on lead-zinc imports, basically the interests of the two North American countries are complementary rather than conflicting. Implicit in the conclusions of the Canadian-American Committee's report is the indication that underlying economic forces are likely to be working powerfully in the direction of greater economic interdependence within North America. This, of course, is by no means incompatible with Canadian aspirations for a more broadly based trade and the more extensive participation of local capital in the development of domestic mineral resources, nor with diversifying the source of foreign holdings in the country. The report should assist in creating a better understanding in both countries of some of the opportunties and problems likely to be presented in the next two decades.

TIN'S STRONG STATISTICAL POSITION

In marked contrast to the weakness of other base metals is the statistical strength of tin. Although prices have recently tended to drift, the tin market remains in a remarkably healthy condition despite a downward trend in demand and consumption during recent months. In the United States production of tinplate for use in the canning industry has fallen substantially during the past half-year, due largely to the running down of stocks. In Britain there has been a similar decline in tinplate production, estimated at about 15 per cent. On the other hand, consumption in Western Europe appears to be well maintained.

Failing any prolonged setback to the American economy, it seems reasonable to assume that a revival of the New York market will not be long deferred and that before the end of the year consumption in the United Kingdom will also have resumed its upward trend. Meanwhile, to quote from the December, 1960 issue of *Tin Market*, the monthly review published by A. Strauss & Co. Ltd., "the statistical position of tin is such that if no severe world trade recession develops, consumption during the next twelve months is likely to exceed production by a considerable margin." In the event of an early ending to the American recession, as is now being more widely predicted, the I.T.C. might well have difficulty in preventing a tight supply position from building up.

The removal of all export controls at the Council's meeting last September occasioned surprise in some quarters and the industry was, in fact, warned at the time that restrictions might have to be reimposed. In particular, it was feared that the market might be weakened by rising shipments from Malaya, the only country where a substantial increase in production was foreseen and where there appeared to be a large tonnage of accumulated stocks.

The present strength of the tin market can be attributed largely to the absence of any substantial increase in Malayan exports. The total shipments of Straits tin in October and November together amounted to some 14,350 tons, but this figure includes Banka tin, which under the new arrangement is smelted in Penang. If Banker is excluded, shipments in both months were not appreciably higher than the previous monthly average. Perhaps of still greater significance is the fact that the reported tonnage of Straits tin sold daily on the Singapore market since the inception of free exports is not much changed from previous months; during the second half of December it actually declined.

The explanation of the failure of Malayan mine shipments to increase appreciably since the end of quota restriction lies mainly in the fact that minehead stocks, which it had popularly been supposed would come on to

the market after de-restriction, had in fact during the early months of the year been progressively eroded down to normal levels in the process of meeting the higher quotas which the industry enjoyed in 1960. In other words, quotas rose more sharply than did the re-activation of Malayan mine production and by mid-year many mines had used up their excess minehead stocks in the process of meeting their quotas.

On the basis of 100 per cent quota production, Malayan output would be about 5,000 tons per month. In fact, from May to November, mine shipments have been pretty steady at an average of rather less than 4,500 tons.

Aside from the non-emergence of any increased Malayan shipments it must be remembered that Belgian Congo production came virtually to a halt in July and that pipeline shipments from that source probably dried up on the market end in October or November, so that there is for the time being a shortfall of about 1,000 tons a month from that source with no early prospect of resumption.

As regards Malayan production, it will be recalled that the chairmen of several major tin companies warned shareholders not to expect any major increase in the immediate future owing to technical reasons. In the case of Malayan Tin Dredging, for example, the company's No. 3A and No. 4A dredges have worked their way into ground containing lower values and production during the current financial year is not expected to reach the previous year's figure. The Ayer Hitam's overall output is bound to be adversely affected for several months while the No. 1 dredge is closed down for modifications designed to increase capacity and tin recovery efficiency. And there are other companies in similar positions.

The immediate outlook thus appears to be for strengthening prices, with consumers cushioned for a while above the £830 level by the buffer stock, which stands at around 10,000 tons plus 3,000 tons of Canadian stocks which that government will feel free, if it so wishes, to sell above this level. There is also the small Italian stockpile of some 2,000 tons which is now gradually being liquidated. Beyond that—nothing, except the U.S. stockpile against any immediate threat to supplies. In the longer term the Achilles Heel of the industry is, of course, the depletion of known ore reserves and the continued absence of new discoveries of major significance.

GREEN LIGHT FOR NIMBA

The Export - Import Bank recently announced the authorization of a $30,000,000 credit to Lamco—the Liberian American-Swedish Minerals Company. This completes the financing of the "Lamco Joint Venture" and the development of the iron ore deposits in the Nimba Range in Liberia is thus assured.

Swedish companies are to contribute about $50,000,000 towards financing the exploitation of the Nimba Range deposits, it was reported in Stockholm last week. The known deposits are estimated at more than 200,000,000 tons of ore with an average content of 65 per cent Fe. Operations are scheduled to start in the first half of 1963 at the rate of 5,000,000-6,000,000 tons per annum, later to be increased to 10,000,000 tons.

The Nimba project, including a 165-mile railway to the port of Buchanan, is owned by Lamco and the Bethlehem Steel Corporation, Lamco holding three-quarters and Bethlehem one-quarter of the interests. In Lamco, half of the shares are held by the Liberian Government and the other half by Liberian Iron Ore Ltd. (L.I.O.), of which the majority is owned by the Swedish Lamco syndicate and the balance by private interests in the United States and Liberia, *inter alia* the International African American Corporation of Delaware.

In the Swedish syndicate, three-sevenths are owned by the Grängesberg Company, two-sevenths by Atlas Copco and Nordströms Linbanor, and two-sevenths by Skanska Cement, Iföverken and Sentab, all industrial companies of high ranking.

The Swedish syndicate has already contributed $28,000,000 of the $11,500,000 in shares plus $38,000,000 in debentures which it is to invest in the project. Part of the debentures may later be sold out, but the Swedish syndicate is always to retain a majority interest in L.I.O.

The entire Lamco joint venture scheme will call for investments within the range of $200,000,000. Of this amount, Bethlehem Steel will contribute $50,000,000. The Export-Import Bank has granted a loan of $30,000,000, the German Kreditanstalt für Wiederaufbau $50,000,000 and the First National City Bank of New York $5,700,000. Most of the bank credits granted will be used for financing deliveries of equipment from the United States and Western Germany.

Under a management agreement between Lamco and Bethlehem, the Grängesberg Company is to handle the construction of the plant, the mining operations and the transport of the ore to Buchanan. Bethlehem is to take about a quarter of the output, while most of the remaining quantities have been placed on long term contracts principally with German steelworks. Sales of Lamco's proportion of the ore output will be handled by Malmexport, the joint sales company of Grängesberg and the Swedish LKAB mining company. Units of the Grängesberg fleet of ore carrier's will be available for transporting the ore.

STEEL REMAINS IN THE VANGUARD

We hear so much these days about "nuclear metals", "space age metals", and even "moon metals", that the traditional materials, by implication, would appear to be in some danger of being regarded as "has beens" or "also rans!" Nothing could, of course, be further from the truth. Take, for example, the case of steel. Not only is this most versatile and adaptable material, in one or other of its many forms, of crucial importance to many of the more novel and spectacular achievements of the present day, but it is itself subject to a continuous process of research and development which ensures that, both quantitatively and in the scope and variety of its applications, steel will remain one of our foremost constructional and engineering materials.

A steel sheet, for example, has many advantages, as Mr. Richard F. Summers points out in his statement to shareholders of John Summers and Sons Ltd. (see page 56), and there is no reason to suppose that its uses in the future will be limited to those which exist today. The application of various coatings to it, notably zinc and plastics, increase its durability and its versatility. Mr. Summers states that the advantages of galvanized or electrolytic zinc coated sheets are being more and more appreciated and their uses are continually being extended. Moreover, the coating of sheets is not limited to zinc and plastics and the company's research people are keeping watch on developments.

As the world becomes more prosperous, Mr. Summers expects to see the demand for flat rolled products steadily increasing, despite competition from other materials. The first stage of the company's Shelton works has accordingly been approved at an estimated expenditure of some £18,500,000. The British steel industry's decision to spend at least a further £450,000,000 on development by 1965 is an impressive indication that this confidence is fully shared by other sections of the industry.

The Future of Industrial Raw Materials in North America

Raw materials projections to 1980 are developed for 46 principal industrial materials consumed in North America in a study prepared by the Canadian-American Committee. This body was established in 1957 to study problems arising from growing interdependence between Canada and the United States. The study has an introductory analysis of background conditions and influences and a discussion of underlying assumptions. Some of its conclusions are here given **(See also page 33)**

THE principal general assumption underlying the detailed projections in this study is that the gross national product (G.N.P.) will increase about 4.9 per cent annually in Canada, 4.1 per cent in the United States, and 4.2 per cent in the two countries combined between the base period 1955-57 and 1980. These rates represent the growth potential indicated by a continued improvement of productivity, expansion of the labour force, and gradually reduced working time per member of the labour force. They are approximately the same as the rates experienced in the postwar period 1947-49 to 1955-57, but about one-third higher than the rates over the period since 1926-28, which, of course, includes the depression of the 1930's and the distortions of World War II and the postwar readjustments. Conclusions on the demand in Canada and the United States for major industrial raw materials by 1980 can be summarized by comparing the anticipated growth in demand with the projections for growth in G.N.P. Such a comparison is shown in the table.

Very large percentage increases in demand, significantly in excess of the anticipated percentage increase in G.N.P. of the two countries combined, may be experienced by natural gas and natural gas liquids ; aluminium ; a number of alloying metals, including chromite, cobalt, molybdenum and nickel; and fluorspar, cement and potash in the non-metallics group. It is expected that the demand for tungsten and gypsum, will increase by about the same proportion as G.N.P. in both Canada and the United States. Among the items likely to increase at markedly slower rates (less than 90 per cent of the increase in G.N.P.) are coal, iron ore, manganese, copper, lead, zinc, tin, asbestos and sulphur.

Turning to the supply-demand picture in 1980, four possible situations can be distinguished : (1) a deficit in Canada and a surplus in the United States ; (2) a U.S. deficit and a surplus in Canada ; (3) a deficit in both Canada and the United States ; (4) no deficit in Canada or the United States. The first situation will likely be true of coal, molyb-

Continued on next page

INCREASE IN DEMAND, RELATIONSHIP OF SUPPLY TO DEMAND, AND CHANGES IN TRADE PATTERNS; ESTIMATES FOR 1980, CANADA, UNITED STATES AND NORTH AMERICA

Commodity and Area	*Increase in Demand 1955-57 to 1980* — *Total Increase (per cent)*	*Percentage Increase in Demand Divided by Percentage Increase in GNP*	*Supply vs. Demand in 1980*	*Probable Change in Trade Patterns by 1980*
Mineral Fuels				
Coal (total)				
North America ..	110	0.66	Surplus	Small increase in exports
Canada	81	0.38	Deficit	Large increase in imports
United States ..	112	0.69	Surplus	Moderate increase in exports
Petroleum and products				
North America ..	148	0.89	Deficit	Moderate increase in imports
Canada	182	0.85	Surplus	Shift from net importer to net exporter
United States ..	145	0.90	Deficit	Moderate increase in imports
Natural gas				
North America ..	203	1.22	Adequate	No net change
Canada	970	4.51	Surplus	Shift from net importer to net exporter
United States ..	188	1.16	Deficit	Large increase in imports
Natural gas liquids				
North America	253	1.52	Adequate	No net change
Canada	2,100	9.77	Surplus	Shift from net importer to net exporter
United States ..	168	1.04	Deficit	Moderate increase in imports
Iron and Ferro-Alloys				
Iron ore				
North America ..	110	0.66	Deficit	Moderate increase in imports
Canada	162	0.75	Surplus	Very large increase in exports
United States ..	108	0.67	Deficit	Large increase in imports
Chromite				
North America ..	189	1.14	Deficit	Large increase in imports
Canada	221	1.03	Deficit	Large increase in imports
United States ..	187	1.15	Deficit	Large increase in imports
Cobalt				
North America ..	315	1.90	Deficit	Large increase in imports
Canada	352	1.64	Surplus	Very large increase in exports
United States ..	314	1.94	Deficit	Very large increase in imports
Manganese				
North America ..	n.a.	n.a.	Deficit	Large increase in imports
Canada	n.a.	n.a.	Deficit	Large increase in imports
United States ..	118	0.73	Deficit	Large increase in imports
Molybdenum				
North America ..	194	1.17	Surplus	Moderate increase in exports
Canada	261	1.21	Deficit	Large increase in imports
United States ..	188	1.16	Surplus	Moderate increase in exports
Nickel				
North America ..	225	1.36	Surplus	Large increase in exports
Canada	286	1.33	Surplus	Very large increase in exports
United States ..	222	1.37	Deficit	Very large increase in imports
Tungsten				
North America ..	n.a.	n.a.	Deficit	Large increase in imports
Canada	n.a.	n.a.	Deficit	Large increase in imports
United States ..	156	0.96	Deficit	Large increase in imports
Other Metals				
Aluminium				
North America ..	468*a*	2.82	Surplus	Moderate increase in exports of metal
Canada	468	2.18	Surplus	Large increase in exports of metal
United States ..	468*a*	2.89	Deficit	Moderate increase in imports of metal
Copper				
North America ..	75	0.45	Deficit	Large increase in imports
Canada	94	0.44	Surplus	Large increase in exports
United States ..	73	0.45	Deficit	Very large increase in imports
Lead				
North America	50	0.30	Deficit	Large increase in imports
Canada ..	50	0.23	Surplus	Large increase in exports
United States	50	0.31	Deficit	Very large increase in imports
Tin				
North America ..	81	0.49	Deficit	Large increase in imports
Canada	81	0.38	Deficit	Large increase in imports
United States ..	81	0.50	Deficit	Large increase in imports
Zinc				
North America ..	65	0.39	Deficit	Moderate increase in imports
Canada	68	0.32	Surplus	Very large increase in exports
United States ..	65	0.40	Deficit	Very large increase in imports
Non-metallic Minerals				
Asbestos				
North America ..	86	0.52	Surplus	Moderate increase in exports
Canada	157	0.73	Surplus	Very large increase in exports
United States ..	81	0.50	Deficit	Very large increase in imports
Cement				
North America ..	190	1.14	Adequate	Supply a local problem
Canada	221	1.03	Adequate	Supply a local problem
United States ..	188	1.16	Adequate	Supply a local problem
Fluorspar				
North America ..	194	1.17	Deficit	Large increase in imports
Canada	238	1.11	Deficit	Large increase in imports
United States ..	188	1.16	Deficit	Large increase in imports
Gypsum				
North America ..	180	1.08	Adequate	No net change
Canada	221	1.03	Adequate	Small increase in exports
United States ..	176	1.09	Adequate	Small increase in imports
Phosphate				
North America ..	181	1.09	Adequate	Small increase in exports
Canada	162	0.75	Deficit	Large increase in imports
United States ..	181	1.12	Surplus	Moderate increase in exports
Potash				
North America ..	n.a.	n.a.	Adequate	No net change
Canada	n.a.	n.a.	Surplus	Shift from net importer to net exporter
United States ..	195	1.20	Adequate	Shift from net exporter to balance
Sulphur				
North America ..	144	0.87	Adequate	No net change
Canada	182	0.85	Surplus	Shift from net importer to net exporter
United States ..	140	0.86	Deficit	Shift from net exporter to net importer

n.a. not available. *a*. Estimate from U.S. is based on change from 1957 to 1980.

denum, and phosphate. These three materials are exported in quantity from the United States to Canada at the present time, and these exports may increase sharply by 1980.

The reverse situation (a deficit in the United States and a surplus in Canada) will likely be encountered in petroleum and products, natural gas, natural gas liquids, iron ore, cobalt, nickel, aluminium, copper, lead, zinc, asbestos, potash and sulphur. With the exception of natural gas, natural gas liquids, potash, and sulphur, all of these products are exported at present in quantity by Canada to the United States. The greatest increases in Canadian exports to the United States are likely to occur in the case of natural gas, iron ore, lead, zinc, and asbestos. In the case of natural gas, Canada is annually discovering about six cubic feet of new reserves for every cubic foot now produced for current use, while the United States is discovering only about two cubic feet of new gas reserves for every three cubic feet of natural gas produced.

Minerals in the third category (a deficit in both Canada and the United States) include chromite, manganese, tungsten, alumina and bauxite, tin and fluorspar. The projected consumption shown for these materials will be realized only on the assumption of greatly increased imports from outside North America. The fourth category (no deficits in Canada' or the United States) includes such items as gypsum and cement, and neither Canada nor the United States will have a deficit of these items by 1980. Marked changes in the trade patterns are unlikely.

The significance of these projections for Canada-U.S. trade is that the United States will rely to a much greater extent upon Canadian sources of industrial raw materials although a northward flow of coal and phosphates may serve as a partial offset to the increased movement of Canadian materials to the U.S. Both countries will also become more dependent upon sources of supply from outside the North American continent. With regard to such materials as petroleum, and petroleum products, iron ore, cobalt, nickel, copper, lead, zinc and asbestos, Canada is expected to increase its exports tremendously to the United States, but is unlikely to be the sole foreign source.

The Beneficiation of Minerals

Some thirty papers were presented during the symposium held at the Indian Institute of Science, Bangalore, in September, 1959, as part of the Institute's Golden Jubilee celebrations. During July, 1960, the papers were published in full in "The Journal of Mines, Metals and Fuels", Calcutta

THE papers presented at Bangalore cover theory of grinding, flotation theory and practice, with particular reference to sulphides, manganese ores, beach sand, etc., heavy media separation, phase separation methods applied to coal and graphite, and certain methods of chemical processing.

One paper only is devoted to grinding ("Theory of Tumbling Mills" by D. N. Bhrany and N. Cubiter). In this paper the relationship between size distribution and energy consumed in fracture is considered and equations are developed relating power input, rate of grinding and size distribution. Results on continuous milling have been recalculated to show a good correlation, whilst the correlation between batch and continuous milling is also shown to be good for both ball and rod mills.

Studies of contact angle obtained for different gases by Venkatadas indicate that, contrary to the assumptions made by earlier workers, the chemical composition of the gas in a bubble has a profound effect on the contact angle. For example, with calcite, although the contact angle remains the same whether CO_2 or air is used, in the presence of a solution of N/500, Na_2CO_3 or NaH CO_3 the angle is increased appreciably. Other salts have little influence, neither does there appear to be any effect on the contact angle of other minerals with the exception of gold and silver. In this case CO_2 increases the angle.

An investigation of the distribution of xanthate on the surface of sulphide minerals was presented by Plaskin and Shafeyev. In this work contact and trace radiographic procedures were employed, which show that there is a non-uniform mosaic distribution of the reagent on the surface of the mineral. Since a sulphide mineral surface is not equipotential, areas of different electrochemical potentiate, both cathodic and anodic, arise on the particles and these areas give rise to an electric field, the gradient of which determines the nature of the distribution of the xanthate on the surface.

A paper entitled "Kinetics of Decomposition of Xanthates" was presented by Rao and Patel. Since oxidation of the collector to xanthogen is known to occur and may have some influence on collecting action, the authors studied the nature of the decomposition of xanthates, and it has been found that the higher xanthates oxidize less readily although the (secondary) iso-propyl salt undergoes the greatest oxidation. In addition to oxidation to the dixanthogen, hydrolytic decomposition also takes place. In the presence of oxygen alone both types of oxidation occur but with carbon dioxide the xanthate undergoes dissociation. When CO_2 and oxygen are present the oxidation is accelerated. Similarly the decomposition of xanthates in presence of a ferric salt has been studied by the same workers. In the presence of oxygen, this salt is found to enhance the oxidation of butyl and amyl xanthate to the corresponding dixanthogens, the oxidation of isopropyl xanthate is not affected, while that of ethyl xanthate is suppressed. Hydrolytic decomposition is not greatly influenced by the ferric salt but the oxidation to the dixanthogen is enhanced in the presence of both oxygen and CO_2. It would appear, therefore, that in general the presence of ferric salts facilitates the oxidation of xanthates to the dixanthogen, particularly when both oxygen and carbon dioxide are present and the subsequent adsorption on the mineral surface is likely to increase the efficiency of the flotation of pyrite.

Investigations have been carried further by examining the behaviour of xanthates on a pyrite surface using a captive bubble and studying the effect of oxidation on the contact angle. It has been shown that in the presence

of oxygen or a mixture of CO_2 and oxygen, the contact angle increases gradually until it attains the value of the corresponding dixanthogen. In the presence of CO_2 the magnitude of the angle decreases and finally vanishes when ethyl xanthate is used; but in the case of butyl and amyl xanthate, the contact angle gradually rises until it attains the value for the corresponding dixanthogen. In other words the surface is very susceptible to oxidation in the pH range of 6 to 7 and although a considerable time is needed to attain the maximum contact angle, appreciable increases are found after about half an hour. It seems likely that the formation of dixanthogen as a result of oxidation is partly responsible for flotation and that although ferric salts have been shown to increase the oxidation, normally no addition is required since sufficient ferric ions are present in the water due to superficial oxidation of pyrite.

The use of fatty acid collectors in the selective flotation of chalcopyrite is also reported by Mohan and Patel. Since Schulman and his associates have indicated that the pH conditioned interaction between fatty acids and base metal ions might be used to float minerals selectively (each metal having an optimum pH for the formation of its basic ions), the theory was examined in respect of the flotation of chalcopyrite from pyrite and hematite using caproic acid as collector. At low collector concentration, some selectivity appears possible but the results of this work appear to indicate that the maintenance of optimum pH value does not play a significant part.

Work in Australia

Blaskett has also described work on an ore containing copper and other sulphides in a phyllite from Rum Jungle. In this case, the gangue consisted essentially of micaceous minerals with a little graphite and although fast selective flotation was obtained in an acid circuit with a pH below 3.5, in neutral and slightly alkaline circuits, flotation was slow and selectivity very poor. On the other hand, flotation was satisfactory in neutral or alkaline circuits after a preconditioning in an acid circuit. Removal of the acid liquid by filtration or neutralization with soda ash or lime, provided the collector was added before neutralizing, was effective. There is evidence that some of the sericite floats because of thin films of either sulphide or graphite but it would appear that part of the sericite floats because it is activated by metallic ions derived from the circuit water.

Such ions would probably be adsorped more readily in a neutral or slightly alkaline solution, so that filtration would remove sufficient to promote good flotation. On the other hand, the only explanation for satisfactory flotation when the collector is added to the acid circuit followed by neutralization before flotation, appears to be that the collector complexes the metal ions so that they are no longer available to activate the sericite.

A study of the selective flotation of zircon from beach sands using the hot-soap technique worked out at Melbourne University, is reported by Subramanya, who demonstrates that provided an acid wash is used, flotation can be carried out in a highly alkaline medium and that the temperature of the soap treatment can be reduced without appreciable change in results.

The recovery of economic minerals from a beach sand containing ilmenite, monazite, zircon, rutile and sillimanite is described by G. Y. Somnay and a flowsheet is suggested in which the monazite and sillimanite are removed by flotation using a cationic collector and aluminium sulphate as a modifying agent, followed by magnetic and electrostastic separation.

The amenability of uraniferous granite (assaying 0.06 per cent U_3O_8) to beneficiation by flotation is reported by Rao and Majumdar, who indicate that using a mixture of oleic acid, petroleum sulphonate and sodium oleate at a pH of 7.5, 90 per cent recovery can be obtained with an enrichment of 5 to 1. An interesting account of laboratory investigations on some of the manganese ores of Mysore is given by S. B. Dasgupta and P. A. Narayanan. The ferrugineous ores can be successfully beneficiated by reducing the iron to magnetite at a temperature of 500 deg. to 550 deg. C., followed by magnetic separation after comminution to liberation size. The siliceous ores usually can be upgraded by gravity, magnetic separation or flotation. An emulsion of oleic acid was found to be satisfactory in most cases at a pH value between 9.5 to 10.5 and employing sodium silicate as depressant for silica. In other cases, removal of quartz using a cationic collector in an alkaline circuit was successful, together with starch as a manganese depressant.

Contact angle studies at a pyrolusite surface have also been made by D. A. Akerkar and V. A. Altekar who have shown that the characteristic contact angle of the oleyl group is about 88 deg. Furthermore, hydrophobicity is produced by adsorption of the undissociated oleic acid molecules at pH values between 4 and 6 and by adsorption of the oleate ion at pH values between 7 and 10 whilst undissociated acid gives a higher contact angle than the ion.

Phase Separation in Graphite and Coal

Using phase-exchange and the Trent processes, Ghose and Sinha have shown that graphite samples carrying 27-68 per cent of ash can be beneficiated so that 3 per cent of ash remains but there is almost no loss of carbon. It is suggested that the Trent process be used, separating in a thin consistency to reduce the impurities followed by a thick sludge phase exchange in a kneading apparatus for final cleaning.

A section of the papers also deals with coal preparation, in which the possibilities of preparing low-ash coals for special purposes (Sarkar, Chakravarti and Basu), studies of the operation of low pressure cyclone washer, recovery of pyrite form washing rejects (Altekar and Vasudeva), and application of the phase separation method (Nayak and Weingaertner), are discussed.

In the paper on low pressure cyclones the authors show that, whereas it was formerly thought that cyclones could only be efficiently operated at relatively high pressures, good results can be obtained with feed pressures as low as 4 psi. The optimum pulp ratio appears to be around 475 : 1 under these conditions, feed being obtained from an overhead tank and better operation is recorded when the cyclone is inclined at an agle of 20 per cent to the vertical.

Other papers presented included "Modern Trends in Iron Ore Beneficiation", "Beneficiation of Ore by Chlorination", "Studies on the Chlorination of Leucoxene" (which indicate that in the presence of carbon, and chlorine, leucoxene is chlorinated leaving most of the sillimanite unaltered, at 600 deg. C. whilst preferential chlorination is improved by small amounts of cerium oxide as a catalyst and by using chlorine containing some oxygen), "The Thermodynamics of Chlorination of Titanium Minerals", "The Applicability of Contact Angle Measurements to Certain Specialized Systems" and "The Importance of Microscopic Petrology in the Beneficiation of Uraniferous Ores".

High Flux Magnets Assist Borehole Drilling

A New Look to an Old Problem

Fig. 1

MAGNETIC elements made of Ticonal G— Material, an advanced permanent magnet alloy, are being widely applied to the recovery of small, loose ferrous pieces from the bottom of boreholes. Developed in the oilfields, magnetic fishing tools have moved into exploratory drilling on a more general basis, forming a useful adjunct to all deep borehole work and regarded by many as standard equipment.

Magnetic fishing, of course, is by no means new in principle. The earliest tool was of the electro-magnetic type and was called a "hell raiser"—aptly so, on account of its facility for lifting little devils in the form of steel scraps from the inaccessible depths of a borehole where they had been causing grievous damage to expensive drilling bits. Such tools, however, required a d.c. generator to energize the magnet, and the power was supplied via a cable subject to twist and wear. Interest in this type of tool became very great after the Second World War, when the oilfields of the Middle and Far East had to be brought back into production. By putting cement and scrap iron into them, the Allies had deliberately "junked" the wells and effectively prevented the enemy from using them. Under such conditions all processes of recovery other than magnetic were of no avail.

Fig. 2

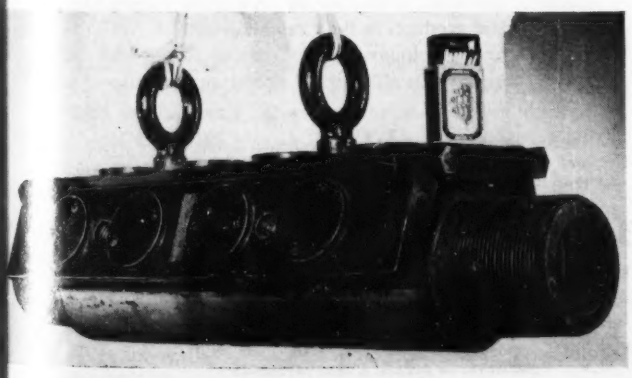
Two main problems are involved in the design of magnetic fishing tools: firstly, the tool must have a powerful axial magnetic field at its face but little or no radial attraction which would cause it to attach itself to steel casing; secondly, provision must be made for flushing fluid to circulate through the tool to wash over any fish lying buried in silt on the bottom of the hole. A range of fishing tools designed by Mr. Burns of David F. J. Burns and Co. Ltd., covers these requirements. By using Mullard Ticonal G— magnetic material as the element, a 7 in. dia. tool is capable of lifting a weight of 150 lb. while the largest, 14 in. dia. tool, lifts over two tons with a full-face pull. Tools are also available for routine use in diamond drill core barrels down to the smallest sizes.

The importance of having a clean hole is perhaps greatest immediately prior to and during the securing of core by diamond drilling. Before the diamond crown is run down, a round trip with a magnetic tool ensures the removal of all ferrous material from the bottom. In this application the magnetic tool may be used flat-face or fitted with "reaming" or "lip" shoes for reaming through cuttings or mud sedimentation. The tools are designed for use on drill pipe, wire line, or tubing. In a second important application, magnetic elements are designed for insertion in the actual core barrel and travel up the inner barrel as coring proceeds, ferrous particles having been picked up when the empty barrel was first lowered to the bottom at the commencement of the run. (Fig. 1.)

Column designed separators (Fig. 2) are available for placing in the mud fluming conveying the mud flush from the borehole back to the storage tanks. Any ferrous particles such as after "milling up" jobs capable of damaging the pump or diamond crowns become deposited on the magnetic sleeve of the separator whence they can be quickly removed. This type of separator is also used in the pottery industry for the removal of fine metallic particles frequently found in clay slurries to the detriment of the finished kilned product.

Among other uses for high flux magnets in the mining industry is the recovery of materials accidentally dropped into the sea at offshore drilling sites. In this case the magnetic elements are incorporated in hinged plates. (Fig. 3.) These can pick up either flat or round materials.

Fig. 3



India's Mineral Resources

(from our own Correspondent)

INDIA'S deposits of iron ore are the best of their kind and the largest as compared to those of any other country in the world, according to the Federation of Indian Chambers of Commerce and Industry. In a recent publication, the Federation assesses India's iron ore deposits at 21,000,000,000 tons, about one fourth of the total world resources. Large deposits of hematite ores are known in Bihar, Orissa, Madhya Pradesh, Mysore and Maharashtra while magnetite ores occur in Madras, Mysore, Orissa and Himachal Pradesh. Extensive resources of limonite ores associated with the spathic ores are present in West Bengal. The proved and indicated reserves of all types of iron ores amount to about 6,800,000,000 tons.

India's coal deposits are also large and they occur very near iron ore deposits. The reserves of all types of coal occurring in seams of one foot or more in thickness within a depth of 1,000 ft. are estimated at 60,000,000,000 tons. Lignite occurs in Madras, Rajasthan, Gujerat, Kutch and Kashmir. Of these, the deposits covering an area of 100 sq. miles in and around Neyveli in the South Arcot district of Madras State are estimated at 2,000,000,000 tons.

A preliminary geological survey of the Tekadi-Sillewara area around Kamptee in Maharashtra State has indicated an estimated 300,000,000 tons of coal deposits, half of it being first grade coal, according to information given in the provincial legislature by the State's Industries Minister.

In respect of bauxite too, the deposits are as good and as extensive as of iron ore. The chief areas are Bihar, Bombay, Jammu, Madhya Pradesh and Madras, which together hold reserves of about 250,000,000 tons. According to a recent estimate high grade bauxite reserves are placed at 28,000,000 tons, of which roughly one-third is in Bihar.

The country's reserves of chromite have been estimated at 1,320,000 tons—mainly in Bihar, Orissa and Mysore. Occurrences of magnesite have been reported from a number of places and total reserves have been estimated at 100,000,000 tons. Fire clays occur in almost all States. The largest deposits of kyanite in the world occur in Bihar. Deposits of sillimanite and corundum are also found in many places. Workable deposits of ilmenite occur in the beach sands of the eastern and western coasts of India, those on the Kerala coast being known for their extensive occurrence. Reserves of ilmenite in beach sands have been reckoned at 350,000,000 tons. India's reserves of gypsum —found in Bombay, Madras, Rajasthan and Jammu and Kashmir—are now placed at 163,000,000 tons.

A Leading Exporter

India is a leading exporter of manganese ore, mica and shellac. In the case of manganese ore deposits she ranks third in the world. Out of a total estimated reserve of 112,000,000 tons, about 100,000,000 tons are in Madhya Pradesh and Maharashtra.

Mica is available in three mica belts of about 1,500 sq. miles in Bihar, 1,200 sq. miles in Rajasthan and 600 sq. miles in Andhra Pradesh. Quality mica—perhaps the best in the world—comes from Bihar. Copper ore is available in an 80-mile belt in Bihar. Recent investigations have proved substantial deposits in Rajasthan.

Recent explorations also indicate extensive reserves of oil in the country. A tentative estimate places the potential oil bearing areas at 400,000 sq. miles.

Provision has been made for the expansion of the Geological Survey of India and the Indian Bureau of Mines in order to intensify the surveys for mineral resources and step up prospecting of those deposits which are to be developed in the public sector.

Iron and Manganese in Mysore

The investigations so far conducted in Mysore State indicate that an additional deposit of 100,000,000 tons of iron ore is available there. The State has reserved 4,000 sq. miles of area for exploiting iron and manganese.

The Mysore Government has also decided to mine 20,000 tons of manganese in Kumsi area and 50,000 tons of iron ore in Sunkadakatte area both in South Kanara district. In this region, it is estimated that 3,000,000 to 5,000,000 tons of iron ore of about 60 per cent grade will be available. Through the Gangully port near Kundapur, it is planned to export 10,000 tons of manganese and 20,000 tons of iron ore. From Apsarakonda (North Kanara), and Biscode and Kalche areas in Yellapur Taluk, it is planned to ship 60,000 tons of iron ore. The ore here is of 63 per cent grade. A scheme costing Rs. 42,700,000 has been drawn up to lay out roads for carrying the ores from mine-heads to ports. By the end of May, 1961, Mysore plans to export through the ports of Karwar and Mangalore, 130,000 tons of iron ore and 40,000 tons of manganese ore.

Lead in the Kariba Scheme

THE November, 1960, issue of *Lead News*, a periodical publication issued by the Lead Development Association, is devoted to the use of lead as a cable sheathing material. Interesting details are given of the cables used in the Kariba hydro-electric scheme.

Power is generated initially by six turbines located in an underground station cut from the rock at one side of the dam, and is conveyed by means of oil-filled cables operating at 330,000 volts, to a sub-station and thence to overhead transmission lines at the surface.

A central spiral steel duct (providing a path for the oil) is surrounded by the layers of high conductivity copper wires forming the conductor, which is then lapped with three metallized paper screening tapes followed by paper insulation approximately 1.1 in. thick. The dielectric is finally screened by another metallized paper and a copper woven fabric tape. The lead alloy sheath (approximately 4 in. outside dia. and $\frac{1}{4}$ in. wall thickness) follows and is reinforced with tin-bronze tapes and armoured with hard drawn aluminium wires. From the underground transformer, the cables first pass through a horizontal tunnel for about 80 yds. and then through a 180 yd. vertical shaft. At the surface, the remainder of the route is over steeply rising ground. In all, there are 12 cables working at 330,000 volts and ranging in length from 572 to 650 yds., a total of about four miles in all. The weight of lead used in the cables is about 70 tons.

In addition to these high-voltage cables some 18 miles of lead-sheathed cables insulated with paper, varnished cambric or rubber have been supplied for the underground power station.

Technical Briefs

Flash Drying Systems

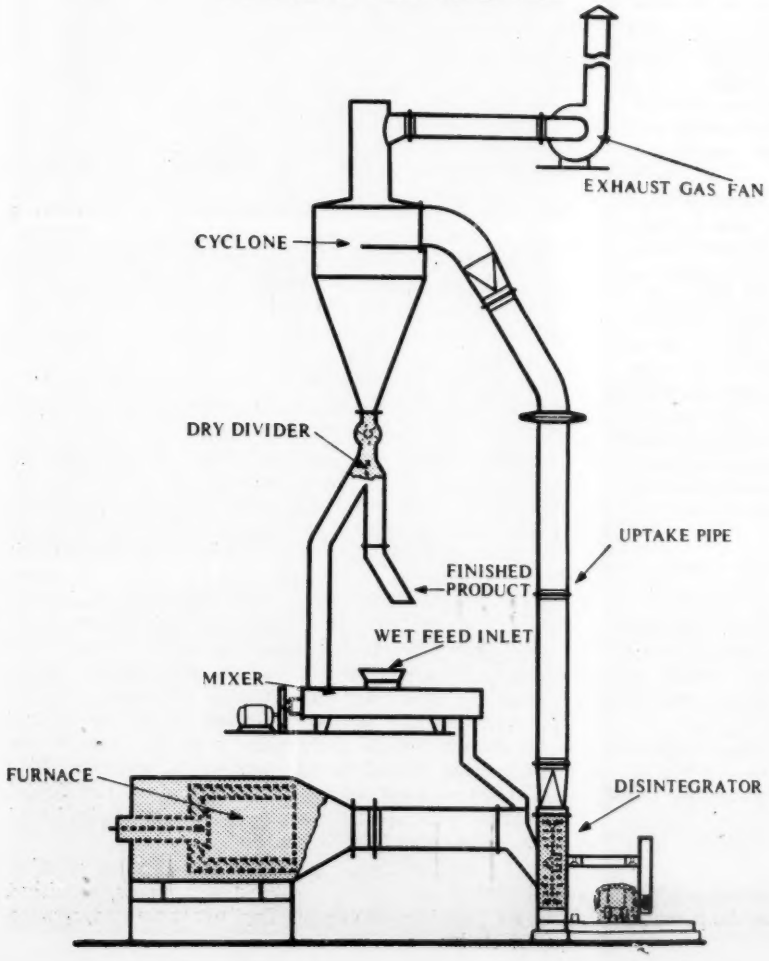
Raymond flash drying systems, now introduced to this country for the first time by International Combustion Products Ltd., are used to remove definite amounts of moisture from damp, granular or fibrous material. The material is circulated in a hot, turbulent gas stream, causing the rapid transfer of heat and evaporation of moisture. When simultaneous drying and grinding is required, a disintegrator or pulverizer is included in the system. The finished product is separated, cooled and conveyed in a dust free plant operating under suction, and its dryness and particle size may be accurately controlled. Raymond flash drying systems are widely used for drying materials such as wet coal cake, and also for the preparation of chemicals.

Flash drying systems are designed to accomplish drying under three distinct conditions: drying without disintegration, drying with disintegration, and drying and pulverizing. The standard elements of the system are given below; some systems require all the elements, whilst others may omit one or more of them.

Hot gas is supplied either by direct firing, indirect heating or the use of waste gas, and International Combustion furnaces operating on gas, oil, or coal, and heat exchangers are designed to meet these conditions. Several wet feeder arrangements are available, allowing the rate of feed to be changed as required. The mixer is used to condition the incoming wet feed by blending it with previously dried material. A product is thus obtained which can be easily picked up by the hot gas stream. A cage or impact mill is incorporated in the system when simultaneous drying and grinding is required. Wet material is fed into the hot gas stream and the mixture then enters the mill axially. The product leaves the mill almost completely dried, but mixed with the gas.

After passing through the uptake pipe, this mixture enters the cyclone collector, where separation occurs, and the moisture-laden gas is discharged to atmosphere through the vent fan. A bag filter, cyclone, or wet scrubber are sometimes included in the system after the exhaust fan. The dry divider proportions the finished product when dry return is needed for conditioning the incoming wet feed. This proportioning device may be either manually or automatically controlled.

The Raymond Flash Drying System



ELECTROWINNING TUNGSTEN AND MOLYBDENUM

Tungsten metal, chemically equivalent to commercial grade, is produced by electrolysis of impure tungsten compounds or scheelite in an alkali, phosphate or borate electrolyte. A preliminary investigation of fused-bath electrolysis shows the effect of electrolyte composition, temperature, and current density on current efficiency, yield, crystal structure, and purity of product. All the investigations on experiments have been carried out by the U.S. Bureau of Mines and are described in *Report of Investigations* 5554.

Experiments show that tungsten can be electrowon from scheelite in a fused alkali, phosphate, or borate bath with similar results. Studies on electrolyte composition show that the addition of sodium chloride is essential to both electrolytes in treating scheelite. Although its main function is to react with or flux the CaO, it also increases the bath fluidity. Temperature studies revealed optimum ranges between 900 deg. and 1,100 deg. C.; 900 deg. C. proved satisfactory for tungsten trioxide, and 950 deg. to 1,050 deg. C. for scheelite. Current efficiencies were satisfactory for all current densities ranging from 10 to 57 a/d.m. Yields were 400 to 650 g./kw.-hr. over the same current-density range. Crystal size and purity of the product are functions of temperature, current density, and amount of impurities in the electrolyte. Deposited crystals vary in shape from spherical grains to clusters of dendritic hexagonal needles, and in size from smaller than 35 to 570 microns. The purity of the tungsten metal produced ranges from 99.7 to 99.94 per cent.

During the investigation of fused-bath electrolysis, it was observed that under controlled conditions molybdenum and tungsten can be deposited selectively. At a low voltage, molybdenum deposits first. In treating a scheelite containing 68 per cent WO_3 and 3 per cent molybdenum, using a stationary graphite cathode, 82 per cent of the molybdenum and 12 per cent of the tungsten were deposited on the cathode. Of this amount 50 per cent of the molybdenum and 1.47 per cent of the tungsten were deposited during the first hour of electrolysis. In another experiment, using a rotating cathode to overcome local depletion of the molybdenum, 98 per cent of the molybdenum and 2 per cent of the tungsten were deposited during 1.5 hours of electrolysis. This phenomenon offers a means of controlling the molybdenum content of electrolytically deposited tungsten without chemical purification of the scheelite before reduction.

Electrolyte reagents are relatively inexpensive. Approximately 67 per cent of the reagents are water-soluble and can be recovered from the spent electrolyte. Power consumption is small, averaging 1 to 2 kilowatt hours per pound of tungsten produced. A systematic research programme has been initiated to delineate the parameters and establish key factors of the electrolytic process for the direct production of tungsten from the mineral scheelite.

MINING MISCELLANY

Dr. J. F. du Toit, chairman of South Africa's Phosphate Development Corporation, reported at the annual meeting that the prospecting programme was being continued on the lower grade pyroxenite ore and that it had indicated that down to 200 ft. some 70,000,000 tons of pyroxenite ore were available.

★

Owing to the effect of the steel slowdown in the U.S. on Canadian iron ore sales, the 1960 autumn shipments of Iron Ore Co., of Canada declined to 10,000,000 tons. Iron Ore Co., which is jointly owned by Hollinger Consolidated Gold Mines and a group of U.S. Steel companies, shipped a record 13,000,000 tons in 1959 and had expected to sell 12,000,000 tons during 1960.

★

Consolidated Mining and Smelting Co. has shipped the 5,000,000th ton of refined zinc from its plants, since the company first started zinc operations 44 years ago.

★

The Russian Central Research Institute for Mining and Prospecting (TSNIGRI), jointly with several other institutions and with Irkutsk engineering industry, have designed and started the construction of what is claimed to be the world's biggest mining dredge. This dredge is to be 230 metres long, 46 m. wide, 40 m. high, and have a displacement of 8,000 tons. The dredging chain has 165 buckets of 600 litres capacity each, and can work down to 50 m. below water level. The dredge will be used for mining gold, silver and diamond-bearing rocks. Seasonal output (when the water is not frozen) will be 3,000,000 cu.m. of pulp. The dredge, which is expected to do the work of 12,000 workers, will be operated by 10 men, assisted by advanced control and automatic equipment and by closed circuit television.

★

A world shaft sinking record recently established by Hartebeestfontein G.M. Co. was aided by pre-cementation of the shaft site by the African company of the Cementation Group. There were no stoppages for water during the record-breaking month of October. The shaft had been sunk and lined to 160 ft. —just below water table—when the pre-cementation crew took over the shaft bottom. With eight diamond drilling machines and four cementation pumps in operation, they treated the underlying dolomite to a depth of 1,600 ft. below surface. Drilling of 16,834 ft. was carried out in 12 holes around the periphery of the shaft bottom—with redrilling of over 20,000 ft. Some 103,000 cu. ft. of cement, slag and slimes were injected. This pre-cementation work was undertaken some months before the start of sinking operations.

★

A new company, Sesa Goa, Ltd., has been set up for the exploitation of ore deposits in the Portuguese Indian colony of Goa by the West German companies: August Thyssen-Hütte, Niederrheinische Hütte, Ruhrstahl and Rohstoffhandels-GmbH, and the Italian Finsider group.

★

Russia is to export considerable quantities of mineral ores, coal and mineral oil during 1961 to Japan, under a trade agreement between the two countries, involving shipments worth $80,000,000 in each direction.

★

Russia is helping North Vietnam to build 43 industrial and mining centres and has granted the country 43,000,000 new roubles' credit to carry out its five-year plan.

★

According to a report in the German *Handelsblatt* about 239 different uranium deposits, with a total estimated uranium oxide content of 2,450 tonnes had been located in the Argentine by mid-1960.

★

Out of a total sum of 45,000,000,000 Nationalist Chinese dollars (about $U.S.1,250,000,000) to be spent on economic development in the third four-year plan of Formosa, some Nat.$1,600,000,000 will go to mining, Nat.$12,800,000,000 to the processing industry and Nat.$5,600,000,000 to power (coal, mineral oil and electricity). Of particular importance is the development plan for the aluminium industry in Formosa.

★

It was recently announced in Tel Aviv that the planned Liberian National Shipping Co. is to have an initial capital of $10,000,000. This Liberian-Dutch-Israeli concern, which will transport Liberian ore to Europe and the U.S. in charter vessels, is to be owned 25 per cent by Israeli business interests, 25 per cent by Verolme Shipyards, and 50 per cent by the Liberian Government. Two ore-carriers have already been ordered for the company from Verolme Shipyards.

★

The Austrian mining company, Alpine-Montan, currently has reserves estimated to contain some 335,000,000 tonnes of mineral ores and 150,000,000 tonnes of coal. During 1960 the company produced about 3,500,000 tonnes of iron ore and 3,400,000 tonnes of coal. Alpine-Montan is planning the erection of a new sinter plant, to cost between 120,000,000 and 150,000,000 schillings.

★

Orchan Mines is to be brought into production at a rate of 1,000 tons daily and is expected to participate, with other Eastern Canadian mining companies, in the construction of a zinc refinery. Underground work is to start as soon as possible, temporary financing being provided by Noranda Mines through a loan to Orchan at 5 per cent. The objective is to have a mill in operation by 1962, states *The Northern Miner*. Diamond drilling at Orchan has indicated that sufficient ore is available to support a 1,000-ton operation for 12 years. Grade is put at 12.7 per cent zinc and 1.3 per cent copper, with other metal values, including some gold and about 1¼ oz. silver per ton.

★

It has been announced in La Paz that the West German company Salzgitter Machinen A.G. has granted a preliminary credit of $4,000,000 to Bolivia's nationalized mines, to be spent on equipment and stores for the mines. This credit is part of a $40,000,000 operation, in which the U.S. Government has a $10,000,000 participation, and the Inter-American Development Bank is to fix the amount of aid necessary when its experts' survey is completed. The British firm of Williams Harvey and Co. have already, through the parent company, Consolidated Tin Smelters, advanced in sterling the equivalent of $2,000,000 against future purchases.

★

Three senior Russian trade officials are visiting the Rhodesian Federation for talks with Rhodesian Selection Trust and Anglo-American Corporation, at the initiative of the Russians. During 1960 Russia purchased 20,000 tons of copper from the Federation.

★

An Interim Committee for the Second International Tin Agreement held its first meeting in London on January 3, 1961, to make such arrangements as are necessary to facilitate the entry into force on July 1, 1961, of the Second International Tin Agreement. It was reported that the second Agreement, which was open for signature up to December 31, 1960, had been signed by or on behalf of Australia, Austria, Belgium, Bolivia, Canada, The Congo Republic (Leopoldville), Denmark, France, India, Indonesia, Italy, Japan, the Federation of Malaya, Mexico, the Netherlands, the Federation of Nigeria, Ruanda-Urundi, Spain, Thailand, Turkey and the U.K. These signatures more than fulfil the minimum requirements which are laid down in the Second Agreement as a necessary step towards the ratification of that Agreement. The next meeting of the Committee will be held on March 7 next.

★

A single stage belt conveyor 12,700 ft. long, and thought to be the longest in the world, has been installed in Australia by Cable Belt of Great Britain. An even longer conveyor, which will be entirely underground, has been ordered by the National Coal Board; it has a length of 13,800 ft. in one stage. The average conveyor belts of conventional length are usually between 1,000 and 2,000 yds.

★

The production of coal in the Asturias, Spain, has fallen by 8 per cent. This is partly due to obsolete equipment in use, but it is hoped that $5,000,000 of U.S. aid may be set aside for modernization of the industry.

★

According to statistics compiled by the U.S. Department of the Interior, at the close of the 1950 fiscal year, there were 1,209 mining leases under supervision of the Geological Survey, covering 1,184,931 acres of land. By the close of the 1960 fiscal year, these had increased to 3,674 leases aggregating 6,995,983 acres, representing increases of 204 per cent and 490 per cent respectively. Production of minerals from federally controlled leases in fiscal year 1960 totalled 26,799,822 s.tons compared with a total of 13,674, 550 s.tons in fiscal year 1950, an increase of 96 per cent in the 10-year period.

Metals and Minerals

A Record Year for the Sulphur Industry

World consumption of sulphur made spectacular gains in 1960, due to a sudden spurt in demand from producers of fertilizers, chemicals and synthetic fibres. Among the features of the year was a sharp rise in the requirements for fertilizer production of such relatively underdeveloped nations as India and Brazil. Most of the sulphur imported by European, South American and Indian concerns is reported to be going straight into consumption; hence demand is expected to remain strong throughout the current year.

The United States sulphur industry increased shipments abroad in 1960 for the third consecutive year and established a new export record. In his annual review of the industry, Mr. C. A. Wight, president of Freeport Sulphur Company, said that Free World demand increased as a result of the high rate of industrial activity.

Preliminary data indicated that U.S. exports of sulphur would total 1,700,000 l.tons, up 100,000 tons over 1959. The new peak was achieved despite an increase of 600,000 tons in the shipments of other producers supplying the overseas markets. All sales of U.S. sulphur outside the North American continent are handled by the Sulphur Export Corporation, which is jointly owned by the four major U.S. Frasch sulphur producers.

In the U.S. itself consumption of sulphur in all forms also reached record levels. Domestic use was estimated to be in excess of the previous high of 5,950,000 tons consumed in 1959. The phosphate fertilizer industry, which had a record year, was a particularly strong factor in the sulphur market.

U.S. Domestic sulphur production rose by about 7 per cent. Output from all sources amounted to an estimated 6,600,000 s.tons, compared with 6,165,000 tons in 1959. Of the total, an estimated 4,950,000 tons was elemental sulphur mined by the Frasch hot-water process from salt dome deposits along the coast of Louisiana and Texas. Of the balance, 725,000 tons represented elemental sulphur recovered from sour natural gas and refinery gases; 425,000 tons sulphur contained in pyrites; and 500,000 tons sulphur in various forms from other sources.

During the year, three new Frasch mines were placed in operation on the U.S. Gulf Coast. The largest new mine was Freeport's Grand Isle project, located seven miles off the shore of Louisiana in 50 ft. of water. This gain in productive capacity was partially offset by the announced closing of two other mines, one in Louisiana and one in Texas.

There still remains considerable excess production capacity in the U.S., which is likely to prevent any immediate increase in the present prices of domestic sulphur. The official posted price of $25 a ton is purely a nominal one, in view of the discounts offered which can, in fact, bring it down by as much as $3.50. A more realistic quotation would be $22.50-$23.50.

A disquieting development for U.S. sulphur producers is the inroads being made in world markets by the French producer, La Société Nationale des Pétrols d'Aquitaine, which is obtaining a growing share of the European and South American markets. This company extracts sulphur from the huge natural gas reserves near Lacq in south-western France. It has been estimated that, of 2,600,000 l.tons of sulphur sold last year in markets outside the U.S., S.N.P.A. accounted for almost 700,000 tons, practically doubling its 1959 sales. U.S. exporters gained about 100,000 tons, while Mexican firms increased their share of the total to 550,000 tons from about 400,000 tons in 1959. There were indications, towards the end of the year, that the price was being strengthened by Mexican sulphur exporters.

In Britain consumption and demand were at peak levels in 1960. There is a small domestic production of sulphur, mainly as a by-product from oil refining. Last year output is estimated to have been around 65,000 l.tons, as compared with 50,000 tons in 1959; a further increase is foreseen for 1961 due to the commissioning of additional oil refining capacity. British sulphur imports totalled about 550,000 l.tons in 1960, of which the U.S. supplied 350,000 tons and Mexico and France 100,000 tons each. Nearly all these tonnages were consumed in the manufacture of sulphuric acid, which was about 10 per cent up on the previous year.

The Tarnobrzeg sulphur plant in Poland was commissioned on December 4 last year, when ceremonies were held at the first Polish sulphur mine in Piaseczno, Rzeszow voivodship. The advantages reaped from this venture, it is stated, will soon be reflected in Poland's balance of trade. Whereas in 1960 Poland required to import 57,000 tons of refined sulphur, she expects to start exporting sulphur during the current year.

WOLFRAM LOSES THREE SHILLINGS

Wolfram ore prices are now indicated at 145s.-150s. per l.ton unit c.i.f. Europe, having fallen by 3s. This is the first change since last October. Fresh buying has latterly been at a low ebb, while some ore of Eastern European origin—possibly Czechoslovakian—was recently sold on the Continent at a heavy discount. It is hoped that the fall in the London price will not be followed by a downward drift which might disturb the stability which has been such a marked feature of the wolfram market in recent months. A reassuring element in the market outlook is the fact that the Communist *bloc* countries are as interested as any others in maintaining a stable price.

QUICKSILVER IN 1960

A moderate increase in mine production at domestic mines, lower imports and consumption, and the lowest annual average price since 1953, marked the U.S. quicksilver industry in 1960, reports the Bureau of Mines, U.S. Department of the Interior. Output at U.S. domestic mines rose slightly from 31,256 flasks in

LONDON METAL AND ORE PRICES, JAN. 12, 1961

METAL PRICES

Aluminium, 99.5%, £186 per ton
Antimony—
English (99%) delivered, 10 cwt. and over £210 per ton
Arsenic, £400 per ton
Bismuth (min. 1 ton lots) 16s. lb. nom.
Cadmium 11s. 0d. lb.
Cerium (99%) net, £15 0s. lb. delivered U.K.
Chromium, Cr. 99% 6s. 11d./7s. 4d. lb.
Cobalt, 12s. lb.
Germanium, 99.99%, Ge. kilo lots 2s. 5d. per gram
Gold, 254s. 11d.
Iridium, £20/£23 oz. nom.
Lanthanum (98%/99%) 15s. per gram.
Magnesium, 2s. 2½d./2s. 3d. lb.
Manganese Metal (96%/98%) £275/£285
Nickel, 99.5% (home trade) £600 per ton
Osmium, £18/£22 oz. nom.
Osmiridium, nom.
Palladium, Imported, £8 12s. 6d.
Platinum U.K. and Empire Refined £30 5s.
Imported £28/£28½
Quicksilver, £69 ex-warehouse
Rhodium, £43/£45 oz
Ruthenium, £14/£16 oz. nom.
Selenium, 46s. 6d. per lb.
Silver, 79½d. f. oz. spot and 79½d. f'd.
Tellurium, 28s. 6d. lb.

ORES AND OXIDES

Antimony Ore (60%) basis	21s. 6d./22s. 0d per unit c.i.f.
Beryl (min. 10 per cent BeO)	240s./245s. per l. ton unit BeO
Bismuth	65% 8s. 6d. lb. c.i.f.
	18/20% 1s. 3d. lb. c.i.f.
Chrome Ore—	
Rhodesian Metallurgical (semifriable 48%) (Ratio 3 : 1)	£15 5s. 0d. per ton c.i.f.
„ Hard Lumpy 45% (Ratio 3 : 1)	£15 10s. 0d. per ton c.i.f.
„ Refractory 40%	£11 0s. 0d. per ton c.i.f.
„ Smalls 44% (Ratio 3 : 1)	£13 5s. 0d. per ton c.i.f.
Baluchistan 48% (Ratio : 3 : 1)	£11 15s. 0d. per ton f.o.b.
Columbite, Nigerian quality, basis 70% combined pentoxides (Ratio 10 : 1) Nb_2O_5 : Ta_2O_5	170s./172s. 6d. per l. ton unit c.i.f.
Fluorspar—	
Acid Grade, Flotated Material	£22 13s. 3d. per ton ex. works
Metallurgical (75/80% CaF_2)	156s. 0d. ex. works
Lithium Ore—	
Petalite min. 3½% Li_2O	50s. 0d./55s. 0d. per unit f.o.b. Beira
Lepidolite min. 3½% Li_2O	50s. 0d./55s. 0d. per unit f.o.b. Beira
Amblygonite basis 7% Li_2O	75s./85s. per ton f.o.b. Beira
Magnesite, ground calcined	£28 0s./£30 0s. d/d
Magnesite Raw (ground)	£21 0s./£23 0s. d/d
Manganese Ore Indian—	
Europe (46%-48%) basis 60s. 0d. freight	73d./75d. c.i.f. nom.
Manganese Ore (43%-45%)	69d./71d. c.i.f. nom.
Manganese Ore (38%-40%)	nom.
Molybdenite (85%) basis	8s. 11d. per lb. f.o.b.)
Titanium Ore—	
Rutile 95/97% TiO_2 (prompt delivery)	£27 10s. 0d. per ton c.i.f. Aust'n
Ilmenite 50/52% TiO_2	£11 10s. per ton c.i.f. Malayan
Wolfram and Scheelite (65%)	145s. 0d./150s. 0d. per unit c.i.f
Vanadium—	
Fused oxide 95% V_2O_5	7s. 6d./8s. per lb. V_2O_5 c.i.f.
Zircon Sand (Australian) 65-66% ZrO_2	£16/£16 10s. ton c.i.f

1959 to an estimated 31,500 flasks in 1960. Production of secondary quicksilver continued at about the same rate as in 1959.

General imports of quicksilver in the first nine months of 1960 totalled 13,300 flasks compared with 22,900 flasks in the corresponding period of 1959. Spain supplied 63 per cent of the total receipts, followed by Italy 17 per cent, Mexico 11 per cent, and Yugoslavia 7 per cent. Total 1960 imports (fourth quarter estimated) fell by 12,000 flasks from the 30,000 flasks imported in 1959 and were the lowest since 1947.

Industrial consumption of quicksilver in the first three quarters of 1960 totalled 37,000 flasks compared with 40,900 flasks in the corresponding period of 1959. Consumption in 1960 (fourth quarter estimated) dropped below 50,000 flasks and was the lowest since 1954. For the sixth successive year more quicksilver was required to replace losses in the manufacture of chlorine and caustic soda, and industrial and control instruments also took more metal. The decrease in consumption resulted chiefly from the fact that, for the first time since 1954, there were no new industrial installations or expansions requiring quicksilver.

Stocks of quicksilver held by consumers and dealers totalled 12,600 flasks on September 30, and were the highest since December 31, 1957. The increase over recent quarterly periods reflected, in part, metal accumulated for future expansion of a chlorine and caustic soda plant. Producers' stocks totalled 1,700 flasks.

Quicksilver prices in the U.S. were fairly stable in 1960. However, the estimated average of $210.75 was about $17.00 below that of 1959 and was the lowest since 1953.

PECHINEY EXPANDS PRODUCTION

Péchiney has informed shareholders that its aluminium plant at Noguères in south-western France has already reached full capacity working at a rate of 60,000 tonnes a year. The plant, which was opened in 1960, uses Lacq natural gas as fuel. During the course of this year its annual production capacity is to be expanded to 90,000 tonnes.

In the first ten months of 1960 Péchiney produced 27 per cent more aluminium than in the corresponding period of the previous year. The company's Chedde plant, also in France, has brought a new 3,500 kVA. ferro-chrome furnace into use, while in Africa the Compagnie Internationale pour la Production de l'Alumine, of Guinea, shipped some 85,000 tonnes of alumina for Péchiney and Ugine in the first ten months.

TINPLATE VERSUS ALUMINIUM

A U.S. company, the Wheeling Steel Corporation, has announced that in March or April this year it will begin commercial production of a new lightweight tinplated steel "specifically designed to meet competition from other

materials in the container field". The Wheeler Corporation thus became the third steel company in the United States to announce definite plans to market lightweight tinplate, which steel experts are banking on to counter an invasion of the can manufacturing market by aluminium. The U.S. Steel Corporation started selling the first of these so-called "thin" tinplates last autumn and the Granite City Steel Co. has announced that it will begin rolling a similar product next spring.

INCO AND LARYMNA

Reports have been circulating in Athens that International Nickel has purchased 67.5 per cent of shares worth $20,000,000 of the company exploiting the ferro-nickel mines at Larymna in central Greece. The concession for the exploitation of these mines belonged to the Greek Chemical Fertilisers Co., whose chairman is the industrial and mining magnate, Mr. Bodossakis-Athanassiades. Commenting on the reports, a spokesman for the Canadian Nickel Co. Ltd., Inco's subsidiary for exploration outside of Canada, stated that its world-wide exploration activities included consideration of the Larymna property, but it was too early to determine whether the company would decide to take up an interest in that property.

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The import by France of nickel alloys from other western European countries and from the dollar area is to be liberalized on March 31.

MAGNESIUM PRODUCTION AGREMENT

An agreement has been signed by Le Magnesium Thermique, of France, and Asahi Kasei, of Japan, under which the latter concern will produce magnesium by a thermal process developed by the French company—a joint subsidiary of Ugine and Péchiney — at its Beaudéan plant.

U.S. BISMUTH CONSUMPTION

U.S. consumption of bismuth in the July-September quarter of 1960 totalled 439,600 lb., according to the Bureau of Mines, U.S. Department of the Interior. This was an increase of 25 per cent over the preceding quarter and was the highest quantity consumed since the first quarter of 1957. Use of bismuth in fusible alloys was more than double the quantity consumed in the previous quarter and accounted for 38 per cent of all bismuth metal consumed. Pharmaceuticals and other alloys showed a decline in use for the preceding quarter, but accounted for 30 and 14 per cent, respectively, of the metal consumed.

General imports of bismuth in the first three quarters of 1960 totalled 868,000 lb. compared with 349,000 lb. in the corresponding period of 1959. The large increase is attributed to high industrial demand, coupled with a decline in domestic production and purchases of about 300,000 lb. of refined bismuth on barter contracts executed by the Commodity Credit Corporation.

Copper · Tin · Lead · Zinc

(From Our London Metal Exchange Correspondent)

A number of bearish factors have been sprung on the market during the past week; as a result there has been some change in sentiment as prices—in some cases more than others—have reached lower levels. After the recent holiday period business has shown some signs of recovery, although current considerations incline buyers to restrict their activities to their immediate requirements.

EL TENIENTE STRIKE AVERTED

The present economic outlook, and in particular reports of further short time working in the U.K. car industry, had already had a dampening affect on the market at the beginning of the week prior to it becoming known in London that a strike at El Teniente had been averted at the eleventh hour. This news was received with a good deal of surprise, as right up until the last moment it appeared that the two parties to the dispute were as far apart as ever. It is clear that only high level government intervention by the Chilean authorities resulted in a formula being reached acceptable to both the Braden Copper Co. and the union. This was for a general 15 per cent wage increase plus certain fringe benefits. It will be recalled that the Chuquicamata strike towards the end of last year was eventually settled on the basis of a 25 per cent increase, but it is not known what special factors have to be taken into consideration in reconciling the apparent difference between the two awards.

The London market reacted sharply to these developments and both quotations dipped below the levels reached during the second half of October last year. At this point some bear covering and modest consumer interest has helped to sustain the market. It had been generally agreed in trade circles that the mere possibility of a stoppage at El Teniente (production about 15,000 tons a month) has been the main prop to the market. This was indeed the last of a series of factors which in their turn during the past year have added some support to the market, so that the current considerable over-production of the metal has not been fully reflected in the world quotations. At the moment there are no factors on the horizon which can be deemed of a bullish nature. Surprisingly, the market shows no inclination as yet to attach any importance to the fighting in the Katanga, which could well develop into an ugly situation. It is concerned rather with what further cutback action will be taken by producers to limit the extent of the downward movement.

In the U.S. business continues extremely quiet and the suggestion has been put forward in some quarters that the present is an opportune moment for the domestic producers to take some remedial action. The producers continue to quote 30 c. although on Wednesday the custom smelters reduced their price by 1 c. to 29 c.

Although official U.K. warehouse stocks showed a small decrease of 175 tons last week to 14,159 tons, a contango has been re-established as buying interest has eased on the nearby position. The official turnover figure for last week was 12,900 tons. Figures have been issued which show that U.K. consumption of copper in November showed a satisfactory increase at 68,168 tons compared with 62,372 tons in October, and at the same time stocks declined to 115,305 tons from 118,033 tons.

TIN EASIER

The quietness of outside demand has found buyers disinclined to operate in the tin market and prices have reacted accordingly. The nearby position has been particularly affected following rather freer offerings of cash metal and a small contango has been established.

U.K. official warehouse stocks last week increased 144 tons to 9,710 tons and the official turnover amounted to 910 tons. Consumption of tin during November increased to 2,164 tons against 1,961 tons the previous month, while stocks showed little change at 11,366 tons compared with 11,237 tons.

On Thursday the Eastern price was equivalent to £790½ per ton c.i.f. Europe.

LEAD AND ZINC

The price concessions initiated by one of the leading U.S. zinc producers which we referred to last week has created considerable confusion in the market, as other producers have announced their intention to meet any competition in the form of discounts. In all events the U.S. quotation has been reduced ½ c. to nominally 11½ c. in the face of poor demand from the major consumers and disappointing December figures which show (in tons):

	Dec.	*Nov.*
Production:	72,933	60,841
Domestic shipments	46,094	56,981
Total shipments ...	64,272	68,980
Stocks end-month ...	190,810	182,149

The London zinc market has tended to follow the downward trend whilst lead values, on the other hand, have been relatively steady. Buyers have been a little more inclined to enter the market at current levels at the same time that selling pressure on both cash and forward positions has been less intense. U.K. official warehouse stocks of lead and zinc increased last week to 7,171 tons and 2,059 tons respectively compared with 6,926 tons and 1,919 tons respectively.

Official turnovers in these metals for last week were 6,000 tons of lead and 7,400 tons of zinc. Lead consumption in November increased slightly at 33,541 tons compared with 32,680 tons during October and corresponding figures for zinc were 32,598 tons and 30,598 tons.

Closing prices are as follows:

	January 5		January 12	
	Buyers	*Sellers*	*Buyers*	*Sellers*
COPPER				
Cash	£223½	£223¾	£216½	£216¾
Three months ..	£224¼	£224½	£217½	£218
Settlement ..	£223¾		£216¾	
LEAD				
Current ½ month	£63½	£63¾	£63¾	£63½
Three months ..	£64½	£64¾	£65	£65⅛
TIN				
Cash	£788	£788½	£779½	£780
Three months ..	£789	£789½	£783	£783½
Settlement ..	£788½		£780	
ZINC				
Current ½ month	£80	£80½	£77½	£77¾
Three months ..	£78½	£78¾	£76½	£77

Mining Finance

South African Uranium Revision

A rise from 10s. 9d. to 15s. 6d. in the 5s. shares of Dominion Reefs—a gain of no less than 40 per cent—and an advance from 17s. to 20s. in Randfontein give some measure of the growing Johannesburg guesswork about the revised contracts between South Africa as the supplier and the United Kingdom and the United States as the purchasers of uranium. Unfortunately, the December quarterly reports from the mines, which it had been hoped would bring the matter out from the realms of speculation into the world of reality, contain no more than a general and uniform statement which at least officially confirms the well-known fact that there is indeed a contract revision.

The statement reads as follows, "discussions have taken place between representatives of the South African Atomic Energy Board, the United States Atomic Energy Commission and the United Kingdom Atomic Energy Authority on new arrangements for the sale of South Africa's uranium oxide. Negotiations are now proceeding on new agreements to give effect to these discussions. These agreements have not yet been concluded, but shareholders will be advised of the new arrangements as soon as possible".

Johannesburg knows that the closing dates of the overall contracts will be extended, as they have already been in Canada. The object of this will be, also as there, to lift some of the embarrassing weight of the over-supply of uranium from the shoulders of the government buyers by means of the suppliers' stretching out the deliveries over a longer period. It is also known in the case of South Africa that the present contract prices will be downgraded.

Why should South Africa accept this? Well, on an inter-government basis refusal might have been difficult to refuse where Canada agreed. Moreover, the revision could in some ways suit the gold-mining industry's book. For one thing, unlike Canada, the majority of the mines are not dependent on uranium for their living. They merely produce it as a profitable side-line to the gold production on the basis of which they originally came into being. The extent to which each mine relies on uranium is shown in the table.

The mines that are now entirely dependent on uranium — and there are some pretty big ones such as Randfontein, West Rand Consolidated and Luipaards Vlei—at present face the possibility that when their existing contracts end in 1964 and 1965 they may well have to shut down because a profitable commercial market in uranium is highly unlikely to have developed by then. It is, in fact, the general opinion even of the optimists that it will not be until the seventies that the present over-supply of the metal is likely to be corrected.

	Gold Profit £	*Uranium Profit* £	*U. Profit of total* %
Freddies Cons.	†96,972	137,081	100
Loraine	†45,452	101,000	100
Randfontein	7,260	508,246*	99
Luipaards Vlei	11,099	270,000	96
E. Champ d'Or	861	22,629	96
Virginia	‡25,566	‡531,341*	95
W. Rand Cons.	41,439	608,194	94
Vogels	59,555	158,000*	73
Western Reefs	399,755	480,719*	55
Harmony	936,333	760,568*	45
Hartebeest	958,484	727,000	43
Welkom	241,877	172,496	42
Buffels	978,039	638,000*	39
Daggafontein	676,643	416,629*	38
Vaal Reefs	742,397	418,401	36
President Steyn	482,542	182,330	27
Blyvoor	1,981,141	486,000*	20
Stilfontein	1,247,295	263,000*	17
Doornfontein	670,887	45,000	6
P. Brand	2,490,064	130,765	5
W. Drie.	3,232,091	147,000	4

* Including acid or pyrite. † Loss.
‡ June quarter figures.

It could thus suit both the industry and the South African Government—which tends to have chronic labour problems on its hands when big mines such as these have to close — to keep them going in the hope that they might be able to remain in business until there is some chance of getting a living from uranium other than through government purchases. It could also, it is being suggested, suit some mines to cease production of uranium and sell their quotas under the new scheme to other concerns which can use them more profitably. It is these kind of details that the market so eagerly awaits. Because not until they are available can there be any chance of sensibly re-assessing the investment prospect of the various shares.

For some mines, of which West Driefontein and Stilfontein are put forward as examples, it may even be an advantage to sell their uranium quotas because of the impact of tax. Uranium profits are taxed on the same scale as those from gold. Moreover, they rank for tax before deduction of loan repayments to the government agency which should, to show the true uranium earnings picture, actually be taken off in order to arrive at the net surplus derived from this metal. Other uranium operations which may be closed down under the new plan include, it is thought, one of the joint scheme plants in the Orange Free State which treats uranium-bearing slimes from the Welkom, President Brand, President Steyn, Loraine and Freddies Consolidated mines.

There is no doubt that the re-arrangements among the individual companies must be causing the Chamber of Mines quite a headache because of the various conflicting factors. For its part, the South African Government has had to face the unwelcome effect on its export earnings of new stretched-out uranium contracts at a lower price. It is believed that the new deal with the U.K. and U.S. authorities solves this problem by an arrangement whereby the

London Market Highlights

Gold shares looked as if they were set for another week of firm prices in quiet trading. But business dwindled even further and prices started to drift lower again. At the same time there was still sufficient selective demand from Johannesburg to keep interest alive. Shares of those mines which are almost entirely dependent on uranium earnings, for example, became a consistently good market on hopes connected with the new contract arrangements, details of which are expected to be announced shortly.

Johannesburg set the ball rolling here with a brisk demand for Randfontein which lifted the shares by 2s. 6d. to 19s. on Friday. They improved further to 20s. by Wednesday of this week and were quickly followed by Dominion Reefs which in three days bounded from 10s. 6d. to 15s. 6d. Others to gain to a lesser extent included Luipaards (7s. 3d.) and West Rand Consolidated (19s. 9d.).

The first of the December quarterly reports made generally little impact on the share market. Loraine, however, bounded 2s. to 28s. 3d. in front of the sharply improved development values. Western Areas were again supported by the Cape but reacted 9d. to 20s. when profit-taking followed the publication of the quarterly report. Free State Geduld (115s.) remained under a cloud for no very obvious reason, their quarterly containing little in the way of adverse news.

After improving in the previous week to 155s. 7½d. following the good December quarter's diamond sales, De Beers held quietly steady. "Casts" tended to edge higher in their ex-scrip issue form; the old shares improved to 15s. 9d. and the stamp-free new to 15s. 9d.

Copper shares also tried to make a firm start to the week, but the adverse factors of a falling metal price and mounting over-production proved to be too much to swallow. Worst hit were Nchanga which dropped from 47s. to 45s. Chartered eased to 68s. and Rhokana came back to 44s. Lead-zincs had similar commodity troubles to face, but share prices stayed fairly steady.

Tin shares fluctuated narrowly. The metal price eased but it was considered that this was merely a temporary move and so the undertone of the share market stayed firm. Tronoh, however, might have been expected to do better than ease 3d. to 38s. 6d. following the excellent second interim for 1960; the payment of 2s. on the 5s. shares made a total to date of 3s. 6d. which with a final still to come compares with the 1959 total of 3s. 1½d. paid on a smaller capital.

Even more sharply increased was the second interim from Idris Hydraulic which was of 1s. per 2s. share. It made a total to date for 1960 of 1s. 4½d. compared with a total distribution of 4½d. last year. The dividend was announced too late on Wednesday to affect the Idris share price of 8s. 7½d. as was the higher final from British Tin. A feature in the Nigerian tin section was Ex-Lands which spurted 9d. to 3s. 7½d. following Press comment on the company's rising earnings and high yield basis.

The growing awareness of the better outlook for silver attracted some attention to San Francisco Mines of Mexico (18s.) and Fresnillo (26s. 10½d.). But perhaps the sharpest rise of the week was the advance of 10s. to 65s., after 68s. 9d., in Griqualand Exploration which followed comment on the company's strong financial position.

U.K. will make good this near-term loss by a loan repayable out of the revenue from uranium as it accrues to the Union Government over the longer period.

At the moment the share market in Johannesburg is undoubtedly reading the whole new set-up as a bull point for languishing uranium shares. The existing U.K. shareholder therein will no doubt decide to await the promised official details which may be forthcoming before the end of the month before taking any steps to reduce his holdings or to buy more. The newcomer should, however, think well after the price rises that have taken place to date before he attempts any anticipation of these official details.

GOOD RESULTS FROM BRITISH TIN

British Tin Investment Corporation surpassed the market's best expectations in its raising of the final dividend on the 10s. shares to 27 per cent making a total of 34 per cent for 1960 against 22 per cent for 1959. The corporation has important holdings in U.K. industrial shares but it is still predominantly interested in tin shares. It is thus an impressive augury for 1961 that the past year's distribution and earnings have risen so sharply. Dividends received from the tin producers during 1960 will have still been on account of a period when output restriction was in force. This was not taken off until October 1 last. Dividends from unrestricted operations have consequently still to come.

The corporation's net revenue for 1960, after tax of £443,659 against £227,058, was £481,281 an increase of £205,226 compared with 1959. The dividends absorb £438,385. The Board, of which Mr. S. H. Smith is chairman, usually pay out up to the hilt. It is explained on this occasion, however, that during the past year certain tin companies in which the group has large holdings brought forward the dates on which they paid dividends. As a result a net sum of approximately £56,000 more was received than would have otherwise been the case. Hence it has been decided to retain in the business the major part of this extra revenue. The carry-forward at £252,462 is thus £48,960 higher than a year previously.

British Tin at 31s. 6d. cum the final dividend offer a yield of 11.3 per cent. In view of the prospect of a further increase in revenue from the tin-mining interests in 1961 they look undervalued.

WITBANK COLLIERY STARTS 1960-61 WELL

Witbank Colliery, the South African coal producer in the Central Mining-Rand Mines group, has made a good start to its sales for the current financial year to August 31 next, 479,871 tons having been despatched in the three months to November 30 last against 418,297 tons in the same period of the previous year. But the chairman, Mr. T. Reekie, points out that there is a likelihood of a reduction in orders during the present South African summer. In addition, sales may be affected as the Coalbrook Colliery regains its former scale of operations. The partial closing of this colliery as a result of the disaster there meant an increased demand for coal from other collieries in the early part of 1960.

Mr. Reekie says that the South African coal industry's efforts to re-enter the export trade have met with some success since the beginning of last year during the first half of which the Transvaal Coal Owners' Association received an order from Ceylon and the Natal collieries were awarded a contract to supply Burma. But, he concludes, it is too early to predict whether or not the industry's efforts to make regular sales to the east will be successful.

DIAMONDS HAVE ANOTHER GOOD YEAR

The full year's diamond sales figures by the Central Selling Organization are now available from which it will be seen that gem sales are slightly up on 1959, itself a record year, by quite a bit. Industrials, although down by some £2,000,000 still reflect the second best trading year ever and, of course, a big advance on the sharp fall off in 1958. All in all revenue from diamond sales through the Central Selling Organization was, aside from 1959, the best on record.

Interest in the immediate future centres primarily on how industrial sales will move in the face of renewed political uncertainties in the Kasai in consequence of the renewal of fighting in the Katanga, and the progress which is being made with the production of synthetic boart both by the General Electric Company of America (*M.J.* Jan. 6, page 21) and by De Beers, who are expected to start commercial production of synthetic about the middle of next year.

Quarter	*Gem* (£*m.*)	*Industrial* (£*m.*)	*Total* (£*m.*)
1959			
March	15.9	7.7	23.6
June	14.8	6.8	21.6
September ...	16.9	6.3	23.2
December ...	15.4	7.3	22.7
1959 TOTAL	63.0	28.1	91.1
1960			
March	14.0	6.4	20.4
June	17.2	6.1	23.3
September ...	15.8	6.8	22.6
December ...	16.5	6.9	23.4
1960 TOTAL	63.5	26.2	89.7

PRONTO NOW MINING COPPER

Rio Algom Mines has commenced production of copper concentrates in its Pronto mill and plant, near Spragge, Ontario.

The Pronto mill discontinued uranium production in the spring of 1960 and has been converted to handle copper ore trucked to it from Rio Algom's Pater property, a haulage distance of less than two miles over a recently constructed road. Pronto's main crushing and grinding equipment has been left in its original location, but certain ancillary equipment has been introduced. Flotation units have also been installed in the existing service building.

The daily copper ore milling rate is to be built up from 500 tons initially to 600 tons in the near future, with a target of 750 t.p.d. to be attained later in 1961. Approximately 50,000 tons of Pater ore have been accumulated on the surface stockpile, providing a substantial bank of ore for the Pronto milling plant. The concentrate produced is to be stockpiled, pending completion of marketing arrangements.

Present ore reserves are calculated at approximately 1,000,000 tons, grading about 2 per cent copper to the 950-ft. horizon. Exploratory drilling is in progress below this depth.

The Pater copper property, located on the north shore of Lake Huron, was acquired through purchase by Pronto Uranium Mines Ltd., prior to the latter's amalgamation with three other Rio Tinto uranium mining companies into Rio Algom Mines Ltd. The Pater orebody was first explored shortly after the discovery of the Pronto uranium orebody in 1953. A diamond drilling and development programme arranged by Dr. F. R. Joubin in 1954 and 1955 indicated an interesting orebody.

Some two years later in 1957, a programme of underground exploration proved up the mine's currently known reserves. At that time, however, the cost of a new plant and the equipment required ruled out the possibility of a profitable mining operation.

Three years later, in the spring of 1960, the closing down of the neighbouring Pronto mine made available much of the plant and equipment which would be needed. This, together with the fact that the Pater operation would provide employment for some of Pronto's former employees, were factors in Rio Algom's decision to re-open and bring into production the Pater mine.

Personal

Mr. W. J. McBride, a director of Edgar Allen and Co., and general manager of the company's engineering division, has visited Russia, accompanied by Dr. A. D. Merriman, consultant to Edgar Allen's engineering division, to lecture Russian executives and technicians on the design and manufacture of cement plant and kindred equipment, and on aspects of steel maufacture.

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Mr. I. A. Taylor has been appointed technical/labour adviser to the Chamber of Mines of Rhodesia.

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Mr. B. N. Jolly has been appointed managing director of E. Boydell and Co., to succeed Mr. E. Boydell, who remains chairman. Following the acquisition of the equity of the company over a year ago by Winget, Mr. R. Ducas, chairman of Winget and Mr. E. F. O. Gascoigne, deputy chairman, are also joining the Boydell Board.

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Mr. G. S. Sutcliffe, a member of the board of Turner and Newall, assumes the chairmanship of Turner Brothers Asbestos Co., subsidiary of Turner and Newall, in place of Mr. N. A. Morling, who is retiring from the board. Mr. Morling is to become chairman of Ferodo Ltd.

Rand and Orange Free State Returns for December

GOLD OUTPUT AND PROFIT

Company	December 1960 Tons (000)	Yield (oz.)	Profit† (£000)	Year ends	Current Financial Year Total to date Tons (000)	Yield (oz.)	Profit† (£000)	Last Financial Year Total to date Tons (000)	Yield (oz.)	Profit† (£000)
Gold Fields										
Doornfontein	105	43,307	230·2	J	630	259,130	1376·6	567	230,495	1137·7
Libanon	115	27,889	69·7	J	700	167,708	419·8	663	155,674	369·9
Luipaards Vlei	65	11,560	4·7	J	405	71,131	30·8	428	75,611	32·0
Rietfontein	14	3,369	0·7	D	184	47,427	59·2	192	50,910	91·2
Robinson	44	10,004	3·5	D	538	119,613	22·4	686	140,812	L110·6
Simmer & Jack	70	12,720	L1·1	D	899	159,979	L38·6	1,006	192,334	L58·9
Sub Nigel	64	14,749	12·3	J	396	90,570	92·8	396	93,673	119·9
Venterspost	114	32,753	68·5	J	732	205,226	468·3	755	193,954	364·9
Vlakfontein	50	18,204	86·6	D	617	222,349	1059·4	610	218,553	1033·9
Vogels	81	17,502	16·8	D	1,020	218,736	242·7	1,091	242,678	401·1
West Drie	130	121,529	1080·8	J	780	736,477	6533·4	625	571,932	4802·2
Anglo American										
Brakpan	146	17,747	17·8	D	1,720	208,793	163·6	1,672	202,677	140·0
Daggas	215	43,452	213·4	D	2,743	554,700	2709·0	2,850	573,963	2801·7
East Daggas	104	17,908	43·0	D	1,270	215,874	501·5	1,208	202,685	414·4
F. S. Geduld	94	81,111	661·7	S	284	245,442	2010·8	280	238,577	1904·2
President Brand	115	91,427	798·4	S	352	280,736	2475·2	347	285,793	2529·0
President Steyn	105	39,283	169·5	S	318	118,605	519·1	307	121,670	577·9
S.A. Lands	98	20,440	49·0	D	1,174	243,887	561·4	1,152	240,564	664·9
Springs	92	12,667	14·2	D	1,194	165,496	171·6	1,147	170,960	157·6
Vaal Reefs	101	46,945	259·0	D	1,194	542,363	2880·0	1,088	490,938	2597·0
Welkom	96	30,431	68·4	S	294	93,604	229·7	291	92,130	229·5
Western Holdings	155	106,175	910·0	S	467	317,809	2728·7	414	269,266	2174·0
West Reefs Ex.	135	38,814	122·5	D	1,663	471,515	1555·8	1,582	418,098	1277·4
Central Mining										
Blyvoor	128	83,035	634·8	J	802	520,552	3978·0	770	504,878	3828·5
City Deep	112	23,138	3·1	D	1,377	281,829	61·2	1,353	282,108	105·0
Cons. M.R.	45	10,410	2·6	J	319	67,175	22·9	560	105,585	44·7
Crown	175	30,978	1·3	D	2,363	403,599	70·1	2,626	419,708	168·3
D. Roodepoort	183	33,694	47·5	D	2,299	420,640	600·3	2,296	423,624	636·4
East Rand Prop.	216	50,928	73·1	D	2,662	642,055	978·9	2,625	684,712	1387·8
Harmony	165	66,821	307·6	J	1,005	406,177	1904·2	843	334,837	1499·1
Modder East	57	7,467	1·6	J	694	69,462	2·2	818	80,161	14·6
Rose Deep	24	4,280	2·2	D	293	51,477	14·2	434	61,719	25·6
J.C.I.*										
Freddies Cons.	58	13,262	L27·3	D	726	159,334	L449·5	708	169,951	L448·3
Govt. G.M.A.	52	9,893	L1·1	D	632	127,491	4·1	635	128,348	L10·1
Randfontein	17	2,653	0·5	D	260	49,715	27·8	415	71,983	94·3
Union Corporation										
East Geduld	120	34,810	214·4	D	1,564	456,719	2913·0	1,653	493,950	3322·7
Geduld Prop.	76	12,761	29·6	D	906	156,573	311·2	879	165,852	353·9
Grootvlei	220	45,534	235·1	D	2,625	545,227	2825·9	2,555	538,309	2793·3
Marievale	94	23,177	123·5	D	1,179	288,789	1524·1	1,135	277,990	1377·2
St. Helena	172	59,784	385·7	D	2,004	684,966	4313·4	1,810	558,434	3126·8
Van Dyk	73	11,290	6·0	D	885	143,417	101·4	891	166,877	321·8
Winkelhaak	92	31,301	175·3	D	1,065	344,616	1754·0	908	235,111	587·1
General Mining										
Buffelsfontein	146	60,225	337·6	J	883	363,883	2001·0	867	331,961	1745·8
Ellaton	26	6,193	21·4	D	335	79,371	290·0	370	85,955	343·1
S. Roodepoort	29	7,183	23·0	J	181	43,529	141·5	180	42,875	137·2
Stilfontein	168	76,380	428·3	D	1,958	885,641	4768·3	1,754	830,892	4901·6
W. Rand Cons.	125	18,359	2·6	D	1,583	228,649	103·6	1,639	235,972	201·7
Anglo Transvaal										
Hartebeestfontein	124	57,784	332·9	J	727	338,479	1960·9	577	295,895	1867·8
Loraine	81	18,399	L13·0	S	245	54,230	L38·9	239	48,488	L55·6
N. Klerksdorp	10	1,114	L6·6	D	130	14,157	L69·9	123	13,793	L95·1
Rand Leases	188	26,508	3·4	J	1,136	162,652	45·7	1,133	168,310	147·7
Village M.R.	30	4,170	L3·9	J	177	25,327	L23·8	180	27,800	3·7
Virginia O.F.S.	129	27,890	L9·8	J	720	153,301	L139·5	800	183,469	98·4
Others										
N. Kleinfontein	72	10,100	1·3	D	940	122,112	11·2	990	127,934	34·0
Wit. Nigel	19	4,301	4·8	J	119	26,471	32·0	111	26,182	30·4

Gold has been valued at 252s. 8d. (November 253s. 10d.). per oz. fine. L indicates loss. † Working Profit. * Working Profit includes sundry revenue. Tables exclude profits from Uranium, Pyrite and Acid, and also production from Uranium divisions at Luipaards Vlei, Randfontein and W. Rand Consolidated.

ESTIMATED URANIUM REVENUE

Company	Year ends	Dec. Profit (£000)	This year (cum.) (£000)	Last year (cum.) (£000)
Goldfields				
Doornfontein	J	14·0	89·0	87·0
Luipaards Vlei (*a*)	J	88·0	538·0	558·0
Vogels	D	52·0	644·0	631·0
West Drie	J	49·0	294·0	300·0
Anglo American				
Daggafontein	D	142·6	1690·3	1666·0
P. Brand	S	46·0	131·2	136·9
P. Steyn	S	64·0	181·6	180·0
Vaal Reefs	D	141·8	1698·4	1719·5
Welkom	S	61·0	172·8	171·1
West Reefs Ex.	D	156·7	1934·8	1918·1
Central Mining				
Blyvoor	J	155·0	961·0	922·4
Harmony	J	239·8	1508·6	1165·0
J.C.I.				
E. Champ d'Or (*b*)	D	5·9*	79·4*	82·5*
Freddies Cons.	D	32·0*	396·0*	424·0*
Govt. G.M.A.	D	23·0*	276·4*	267·6*
Randfontein (*a*)	D	101·8*	1250·2*	1288·5*
General Mining				
Buffelsfontein	J	209·0	1265·0	1271·0
Ellaton	D	18·0	203·0	214·0
Stilfontein	D	90·0	1063·0	1043·0
W. Rand Cons. (*a*)	D	203·0	2480·8	2443·8
Anglo Transvaal				
Hartebeestfontein	J	233·0	1462·0	1572·6
Loraine	S	31·0	99·0	109·0
N. Klerksdorp	D	11·0	126·5	131·5
Virginia O.F.S.	J	181·8	1052·0	1062·4

Tables include profit from uranium acid and pyrite before loan redemption. (*a*) Total profit from uranium section. (*b*) Overall profit. * Net revenue after provision for loan redemption.

JOHN SUMMERS & SONS, LTD.

PRODUCTION RECORDS BROKEN

The annual general meeting of John Summers & Sons, Ltd., will be held on February 2 in London.

The following is an extract from the circulated statement of the chairman, **Mr. Richard F. Summers :—**

The year 1959/60 not unexpectedly produced its problems and difficulties. We were endeavouring on the one hand to maintain production and on the other to carry out very far reaching alterations and modifications to certain sections of our plant, some of these alterations being of a highly complicated nature. We are naturally disappointed that these changes have taken longer than had been expected, but in spite of the difficulties there was in fact an increase in the make of pig iron and steel ingots and a modest increase in deliveries of sheets.

In my statement last year I indicated that we did not expect to be able to report any large increases in production or profits in 1960. Taking everything into consideration I feel that our results are not unsatisfactory, and I hope you will agree that the increase of 2½% in the effective rate of dividend to a total of 15% for the year is reasonable in all the circumstances.

As the result of a lot of hard work by all concerned substantial progress was made during the year and we are hopeful that within a matter of a few months practically all the major alterations at Shotton will be complete. In recent months production records have been broken in practically every Department of the Works.

Future Demand

At the time of writing three months of the current financial year have passed and it is satisfactory to be able to report that by comparison with the similar period last year production has increased, with an improvement in the financial results. Thanks to the strength in the capital goods market and demands from a number of other industries on paper our order book is full, but it is common knowledge that recently there has been a distinct slackening in demand from the motor industry and the manufacturers of durable consumer goods. Part of this may well be seasonal and part due to a falling off in export markets.

The position is also adversely affected by the fact that a number of our customers, unable to get all their requirements from home suppliers, placed substantial contracts abroad, but with the recent falling off in consumption a large quantity of these imported sheets is still in stock in their plants. There is a prevalent view that there will be an improvement in the position in the Spring. If this does turn out to be the case we should be able to dispose of the output from our increasing capacity with, I would expect, a beneficial effect on profits. In any event I should be very disappointed if we could not dispose of more than we produced last year.

Whatever the future may hold we shall continue to strive for greater efficiency and economy, and will continually watch for new developments and techniques and not hesitate to apply them when they would appear to be to our advantage.